Central Marine Fisheries Research Institute – Leading the Way in Tropical Marine Fisheries Research

Grinson George* and A. Gopalakrishnan**
Central Marine Fisheries Research Institute
Kochi 682 018, Kerala
director@cmfri.org.in

In the early 1970's, India was a country dependent on foreign ships with wheat and food grains coming to our ports to feed the population. With the scientific and diplomatic acumen of visionaries like Padma Vibhushan Prof. Dr.M.S. Swaminathan, our country was transformed,with enough surplus food grain in the buffer to feed the population for a year in the event of severe crop loss. Other allied agricultural sectors in the country also developed in the meantime to supplement the dietary requirement of Indians. Fish is a major food commodity in India.India is the second largest producer of fish in the world, contributing to 5.68% of global fish production.India accounts for 2.5% of the global fish market and the fisheries sector is a source of livelihood for over 1.44 crore people. During the 11th five year plan,the fisheries sector contributed 1.1% to the GDP.Contribution to agricultural GDP in the year 2014-15 was 5.3%.Total production during 2013-14 is at 9.58 Million Metric Tonnes (MMT),(Marine-3.44 MMT and Inland- 6.14 MMT).Overall growth in fish production in 2013-14 was 5.9%(Marine- 3.7% and Inland- 7.3%). Fisheries is one of the major forex earners with revenue reaching Rs.18,856 crore in 2012-13, accounting for about 18% of agricultural exports.During 2013-14 the volume of fish and fish products exported was 9.8 lakh tonnes, worth Rs. 30213.26 crores.

For improving the marine fisheries sector of India, the Central Marine Fisheries Research Institute was established by the Government of India on February 3rd 1947, under the Ministry of Agriculture and it joined the ICAR family in 1967. During the course of over 65 years the Institute has emerged as a leading tropical marine fisheries research institute in the world.Since its inception, the CMFRI has grown significantly in size and stature and has built up adequate research infrastructure and recruited qualified staff. During the first half of its existence, its research attention was primarily directed

* *Senior Scientist*
** *Director*

towards the estimation of marine fisheries landings and effort, taxonomy of marine organisms and the bio-economic characteristics of the exploited stocks of finfish and shellfish. This research effort contributed significantly to India's marine fisheries development from a predominantly artisanal, sustenance fishery till the early sixties to that of complex, multi-gear, multispecies fishery.

One of the major achievements of CMFRI is the development and refinement of a unique method for estimation of fishery catch and effort from the over 8000 km coastline called the "Stratified Multistage Random Sampling Method". With this methodology the Institute has been maintaining the National Marine Fisheries Data Centre (NMFDC) with over 9 million catch and effort data records from all maritime states of India for more than 1000 fished species.Since CMFRI makes estimates of marine fisheries landings from all of the Indian coast, voluminous information is generated which is processed using the most modern tools and computer applications. This necessitates codifying all the species which are caught and landed. The CMFRI, has therefore, coded (4 digits) all the species which are caught, incidentally caught and some which are likely to be caught in future. The list is constantly under revision because of nomenclatural changes and additions to the list. The listing is also published in print for use by field data collectors.

During the early nineteen seventies, the CMFRI realized that capture fisheries production alone would not be able to cater to the needs of our growing population and it became very clear that there was need to supplement capture fisheries with production from coastal mariculture and sea farming. Consequently, a major part of the research effort was diverted towards sea farming and coastal mariculture and this effort paid rich dividends in the form of viable farm and hatchery technologies for shrimp, edible oyster, mussel, clam, seaweeds and marine pearls. Besides, human resources in mariculture were successfully developed through the Postgraduate Programme in Mariculture, offering M.F.Sc. and Ph.D. courses. The Institute has developed several bivalve hatchery and culture technologies and mussel culture has become very popular in Kerala, with production of about 20000t/ year. The institute has also developed breeding and seed production technologies for 15 species of high value ornamental fish.

Subsequently, with the infrastructure and expertise built over half a century and looking towards the future needs of the nation, CMFRI began to undertake research in new areas such as marine finfish farming, biotechnology and biodiversity. Along with this, fisheries management plans for each maritime state were formulated and the Institute addressed climate change issues affecting coastal habitats and fishers. In the mariculture front, commercial bivalve farming became a popular women empowerment programme in the beginning of this century. The new knowledge and technologies developed in finfish farming have been transferred to end users and many cutting edge technologies have been patented in marine biotechnology.

The Institute's multidisciplinary approach to research in marine capture and culture fisheries has won it recognition as a premier Institute comparable to any well-established marine laboratory in the world.It is important to have robust estimates of fishery potential as an aid to manage fisheries resources in the EEZ. However, so far we have been unable to arrive at figures that are widely acceptable by experts in the field. Prime focus on future fisheries resource research will be oriented towards building a spatio-temporal database on the GIS platform as a decision support tool. Numerical and time-series model data and databases from RS-GIS sources have taken a priority over real time observations and have revolutionised our research. But the evident gaps between *in-situ* observation and assessment of fishery resources have to be nullified through regular survey, sampling and analysis. Automation of landing data estimation, geo-referencing of fish catches, local spawning and fishing ground

delineation, resolving physical process supporting the fishery resources, the resource vulnerability to climate change, resource economic evaluation and international trade policies impacting our resources are few research areas to be given due attention in the next few years. With the climate change impacts making Indian fisheries sector vulnerable to forces other than over-exploitation, the ChloRIFFS (Chlorophyll based remote-sensing assisted Indian Fisheries Forecasting System) programme calls upon a thorough revalidation involving interdisciplinary efforts in marine fisheries research to point out the lacunae and set-right the contradictions between predicted and harvested resources.

Climate change is one of the biggest global challenges facing mankind and governments are looking for practical and time-bound strategies and plans for mitigation and adaptation. With the major share of marine fish catch coming from coastal and near-coastal waters, any environmental change in this zone would have debilitating impact on the sector in specific and on the country's food basket in general. Such aberrations in the marine environment are bound to affect the fish culture initiatives on the land too. Climate change is projected to exacerbate the abundance and availability of the coastal fish stock and is bound to act as a major factor in triggering collapse of stocks in the near future. Warming of waters and sea level rise are two such pervasive factors, which may severely impact the fishery comprising both the resource and its tappers. The patterns exhibited by this environmental upheaval warrant concerted efforts by various domains to study, understand and counter them. Hence, a multipronged research initiative has been set in motion, focusing on all the natural resources including fishery resources.

Knowledge of stock movement and advisories to the fishermen regarding the availability, season, and abundance of trans-boundary fish such as high valued yellowfin tuna is essential for optimal sustainable harvests. Very few countries in the world have been able to achieve this. However, highly motivated CMFRI scientists have succeeded in pop up tagging efforts, joining an elite group in the world. Design and development of energy saving selective fishing gear systems through material substitution lead to substantial fuel savings for fishermen. Energy saving trawling technologies such as high speed demersal trawls, trawls for deep sea operations and large mesh semi-pelagic trawls are some other innovations in this direction.

Trawl bans are a long term management measure. Very few countries in the world are able to close the fishing operations on a large scale. Over the years,CMFRI, in association with other research organizations and associations / NGOs,has recommended a close on the mechanized fishing for 47 days on both the coasts and the Department of Animal Husbandry, Dairying and Fisheries of Ministry of Agriculture has been able to successfully implement the ban. This measure has a long term positive effect.

Sustaining/rebuilding the marine ecosystems; tidal mudflats, wet-lands, mangroves, marshes, estuaries, beaches, lagoons and coral reefs; have also become a prime responsibility in marine fisheries management. Along with the fishing pressure there is a concern about habitat degradation also. CMFRI for the last 6 decades has contributed immensely to biodiversity conservation and continues to do so. A major activity by CMFRI in this direction is with respect to artificial reefs.Artificial reefs are for enhancing sustainability of artisanal fisheries and increasing productivity naturally. CMFRI has designed and established artificial reefs along the Tamil Nadu Coast at 50 places, with catch rates increasing at all locations, with up to 10 times the previous catch reported in some. The establishment of artificial reefs may also be considered as an alternative rehabilitation option to mitigate the effects of developmental activities such as nuclear power plants.

Millions of people in India suffer from rheumatic arthritic pains. It is heartening to note that CMFRI with concerted and focused research was able to

develop and commercialize Green Mussel extract (GMe) from green mussel and Green Algal extract (GAe) from seaweeds which are natural, cheap, cultivable and proved to safely and effectively relieve the pains, which is a great service to the society.

Demonstration of open sea cage culture indigenously designed and developed by CMFRI, for the first time in India, was successfully accomplished in most of maritime states with high value local species. This has led to raised awareness and increased interest among fishers and state officials. However, to further propagate this on large commercial scale, open water leasing policies have to be formulated by different maritime states. Several training programmes involving all states including UT of Lakshadweep were conducted and a few farmers have already started commercial operations, with the help of Government sponsored subsidy schemes. Considering mariculture is the best option to enhance the production of high valued fish in India, particularly in the context of promoting fish as health food, seed of the high valued fish which are rare in nature are being developed.Breeding of high value marine fish all over the world is highly challenging and though we are late entrants to the field, CMFRI successfully developed the brood stock, induced breeding, seed development and suitable farming technology for four species *viz.*, cobia, silver pompano or American pomfret,orange spotted grouper and red snapper.

Sustainable fisheries management options, if implemented properly, indicate possible enhancement of harvestable potential in Indian EEZ to an extent of 6 million tonnes per annum or more. Opportunities in open sea cage culture and related developments in the field of mariculture during the last 5 years show a way forward in open sea mariculture practices and propose a production ideal to the tune of 4 million tonnes per annum in the coming years from mariculture sector alone. High mariculture production in countries such as China is due to production of sea weeds and molluscs,but the Indian sea food market comprises mainly of fin fishes of edible standards. If properly implemented, there are possibilities that the marine fish production may be enhanced to the tune of 10 million tonnes per annum (6 million tonnes from capture and 4 million tonnes from mariculture) by 2050.

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